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ABSTRACT

With an emphasis on planning and manipulating the supply of health personnel, this report suggests a method of determining state health manpower needs within the context of uncertain demand and incomplete control over supply. Using Illinois as a case in point, the report suggests that health manpower planning, especially at the state level, should provide for flexibility and give attention to: (1) estimates of demand for medical care, (2) predictions of future medical production functions, and (3) advance estimates of the results of policy decisions. It also suggests that health planning should design supply systems that can respond to changes of demand or to short-run predictions of demand change. The report discusses a number of policy instruments that may be useful at the state level for affecting the numbers and distribution of health personnel, including physicians, dentists, nurses, and allied health professionals. (JS)

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STATE HEALTH MANPOWER PLANNING: A POLICY OVERVIEW

Jan Acton and Robert Levine

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PREFACE

This Report is part of Rand's ongoing program in research on health care. The focus of this present study is on *ways and policies* to increase manpower in the health fields and not just *planning* for numerical growth in manpower; it is important to analyze not only the numbers of various types of personnel educated in the health care field, but also the employment and use of these persons.

The work presented here is intended primarily as the context for projects on health manpower policy and planning, particularly planning by states. Much of the continuing substantive work being done at Rand in this area is in response to clients' needs for immediate answers to short term operational questions. Stringing together such immediate answers from year to year, however, can be misleading for long-run policy. Therefore, this Report is an attempt to make explicit the context within which the major portion of our health manpower research is being done.

SUMMARY

This Report suggests an approach to state health manpower planning within the context of uncertain demand and incomplete control over supply. Rather than attempt to estimate future health manpower imprecisely, the emphasis of this Report is on planning and manipulating the supply of health personnel without precise estimates of demand.

The key to this planning is the recognition of imprecision in (1) estimates of demand for medical care, (2) predictions of future medical production functions, and (3) advance estimates of the results of policy decisions. As a result of this imprecision, planning must be flexible enough to meet uncertainty. Instead of concentrating on existing supply to meet long-run demands, health planning should design supply systems that can respond rapidly to changes of demand or to firmly based short-run predictions of demand change.

Existing literature on health manpower location is reviewed and its application to the state of Illinois is discussed herein for the availability of physicians, nurses, and allied health personnel.

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I. INTRODUCTION

The strongest lesson to come out of even a cursory study of future demands for health manpower and the means for satisfying these demands is that a large core of uncertainty exists that cannot be reduced by better planning or analysis. Nationally, similar uncertainties of the past have led to successive predictions of dire shortages of health manpower—each prediction being made at a time of assumed equilibrium but a time that had been the predicted date of a health crisis according to the predictions of a few years before. And national health planning is simple relative to that done by the states; physicians and other medical personnel trained within the United States at least tend to stay within the country.

The focus of this Report has been deliberately broadened from manpower *planning* to manpower *policy* because the former typically concentrates on a narrow set of questions; for example, How can we produce a given number of X-type professionals by year T? In the process of working within such narrow constraints, a number of important questions get lost—questions such as: How many X-type professionals do we really want? How else could we get the services they produce? Where will the professionals we train end up practicing? Might other professionals be used in place of the X's? And, how will the industry in which the X-type professionals work, and consequently the demand for X-types, be changing?

The combination of this broader policy focus and the existence of widespread uncertainties relating to health care shows the necessity for a different style of health manpower planning. We argue that what is needed, especially at the state level, is a flexible system that responds to the changing conditions of a particular state. Furthermore, emphasis must be placed on policy instruments that are both under the state's control and likely to have effects within the state—chiefly, changing the incentives for professionals to locate in the state (regardless of where they trained), reconsidering the rules under which health care is practiced in the state, and, for some cases, influencing in-state education. The option to change the rules of practice should not be ignored, because one of the important sources of uncertainty is not uncertainty about the level of demands for health services, but rather uncertainty about delivery systems which will be permitted.

To begin with, one must ask what the aim of health planning is. In general terms the aim is to provide better health care for the population of the state in

question, but this is so general as to be ambiguous. Operationally, does it mean increasing the number of health personnel and their ability to care for patients on a quantitatively aggregated basis throughout the state, or does it mean that important attention must be paid to location within the state? Does it mean health personnel in general, or does it mean physicians in particular? Does it mean any physician or does it mean physicians educated within the state? In fact, the socially important aims are the broader ones: both state aggregates and within state locations; health care including but not limited to physicians; personnel whatever their source, not merely from within the state. Studies of health care frequently devolve into studies of physician education which—particularly for any individual state—is only a small part of the problem.*

In the next sections we discuss a number of policy instruments that may be useful at the state level for affecting the numbers and distribution of health personnel. We indicate both the direction and magnitude of expected impacts when data allow, and present a preliminary assessment of the costs of some policies that are discussed.

*This may be partially justified by another objective not considered here—that of providing opportunities to citizens of the state to become physicians. The health care objective, however, is the central one.

II. SUPPLY AND DEMAND OF HEALTH CARE

The problem of health manpower planning begins with the difficulties of defining and forecasting future demand for care. We are using "demand" in the economist's sense, which suggests that even as crucial a service as health care will be called for in different quantities, depending on its price. Instead of considering demand, current utilization rates or some arbitrary norm have usually been applied and future "needs" have been projected.

J. E. Eckles and G. C. Sumner (1970, p. 9) have pointed out in detail that "needs forecasts" made in the past have varied widely, depending upon the method used. Such forecasting is by no means an exact science. "... forecasting future manpower requirements ... almost always requires a heavy subjective input."

But there is one bit of consistency in past forecasts of such needs:*

> Almost without exception, manpower forecasts predict a future shortage. This observation appears to hold independent of the time period involved or the time at which the forecast was made. Since some forecasters have chosen to use the status quo as a manpower standard, interesting contradictions have resulted. In 1948, the Ewing Report predicted that by 1960 there would be a serious shortage of physicians unless certain recommendations were carried out. Although these recommendations were not acted upon and by the standards assumed in the report, it appeared that there was a manpower crisis in 1960, there was certainly no widespread discussion of such a physician shortage in that year. In fact, the often referenced Bane report then proceeded to use as manpower standards those physicians to population ratios that occurred in 1959 in order to predict that in 1975 there would be another shortage of physicians.

In other words, "needs"—however they are defined—frequently are filled by changing some standard on the basis of which the "needs" have been calculated, rather than by changing production of manpower. In part, this is because needs can never be precisely defined. For example, those who talk about needs as such fre-

*Eckles and Sumner (pp. 10-11).

quently ignore the economist's concept of demand, according to which demand goes down as prices go up; even in a field as crucial as health care, the dependence of demand on price cannot be avoided. On the other hand, economists sometimes consider only market supply and demand relations and ignore the strong public objective of making health care less dependent upon income distribution so that in this field the price, whatever it is, may be paid by the poor as well as the better off. In any case, the point here is not to solve the health needs or demand conundrum, it is to point out that prediction of future demand has been imprecise in the past and is likely to continue to be so into the future. Health planning must thus live with a continuation of high uncertainty rather than assuming that the next demand forecast will somehow be right on the target.

The supply of health services presents at least as great a picture of uncertainty. Generally, we consider supply to be a quantity/price relationship in which —all other things remaining the same—more services are forthcoming only at a higher price. There are several factors, however, that introduce uncertainty. First, all other things do not remain the same. The technology of medicine changes and the productivity of personnel is affected; other types of health personnel come into use; and institutional factors (for instance, clinic settings or hours-of-work regulations) change. Second, the supply curves may not reflect normal assumptions of economic theory. The major reason is that physicians and other purveyors of health services are not competitive profit maximizers. They do not change "what the traffic will bear" but preserve an ability to change prices at a given time for reasons unrelated to current supply/demand relations.*

The importance of supply uncertainty can be seen by considering the plight of a service-poor area. The operationally significant uncertainty is not about the level of demand—it is higher than supply at all levels of prices being observed. The real uncertainty is about the supply schedule: How many physicians and nurses will come into the area and how hard will they work? Will ancillary personnel be allowed to assist them? Will a Neighborhood Health Center be established where no one is willing to open up a private practice?

The focus here, then, is not on estimating imprecise future supply and demand, but on planning and manipulating the stock of health personnel in the context of our inability to predict precisely. This inability to predict provides one reason for the difficulties in planning supply; for states and localities, another reason is provided by the fact that control for oversupply is quite incomplete. Nationally, the stock of at least the most highly trained of the health professionals—physicians, dentists, and perhaps nurses—may be varied by publicly financing increased training of these professionals. From the state's viewpoint, however, such subsidies will be wasted if the subsidized trainees move out of the state, and for many trainees and for many states, mobility is high. Thus, for the states, the tenuous command over

*As examples, Newhouse (1970) finds that physicians charge more where the physician/population ratio is higher, and Lewis (1969) finds higher surgical procedure rates where there are more surgeons (having controlled for beds per capita and physicians per capita). See also Newhouse and Sloan (1971) for further discussion.

new personnel supply compounds the uncertainty of demand to make planning very difficult indeed.

Under these conditions it is possible to take one of three alternative planning approaches:

1. The first approach would be to take as given all the short-run quantitative and other relationships among the factors producing health care. This means straight-line prediction of the sort that has produced the successive forecasts of personnel shortage. It also means an inability to either predict or recommend steps that will ease such shortage. It implies that existing methods of medical education will increase production of medical personnel by increasing the inputs into this education in a known mix; it also implies that the personnel produced will continue to provide health care in the existing fashion. The questions raised here are answerable, and the answers may be useful for short-run planning, but the results are so constrained that they are far less useful for any planning beyond a year or two.

2. At the other end of the planning spectrum is the kind of planning that takes nothing as given and looks for optimality by varying all inputs. This planning approach assumes the feasibility of changing the technological relationships of medical care, and it assumes the changeability of all institutional relationships. It looks for that production function for medical care (that is, the combination of different types of medical personnel, equipment, drugs, and techniques of care) that is most cost-effective in terms of some selected criteria for health care. Intellectually, and for the purposes of long-run improvement of health care, this kind of planning may be the most important to carry out. Without major changes in the production function, the increasing medical possibilities for lengthened life and improved health may be available to the population only with a vast and massive increase in the number of doctors. This latter may not be possible and the consequent dilemma of whom to let die will be difficult to solve. However, even though such optimization planning is crucial, those doing the five- and ten-year planning to provide the supply of future medical personnel cannot *assume* complete and optimal change of production functions. For just as linear planning leads to false predictions of shortage because production functions do change, counting on optimization may lead to real shortages because such functions do not change that rapidly.

3. What remains, then, is a kind of intermediate-run state health manpower planning approach, whose object is to look across a broad range of possible policy measures and examine which of these (taking uncertainty into account) may be worthwhile for the state to take up. The assumption here is that the health production function will in fact change, but only modestly within five- or ten-year planning periods. And the objective of the planning is to improve health care within the state and its jurisdictions by whatever method seems feasible within the limitations imposed. The key to such planning is the recognition of imprecision in estimates of demand for medical care, imprecision of predictions of future medical production functions, imprecision in advance estimates of the results of various policy decisions. And as a result of this imprecision, the key to planning must be flexibility with which to meet uncertainty. Rather than planning supply to meet long-run demands,

planning must try to design systems that can respond rapidly to changes of demand or to firmly based short-run predictions of demand change.

We are suggesting, then, a mode of planning that at the same time takes account of a state's limited ability to control its own future and of the planner's inability to predict this future. What comes out is likely to be substantially less satisfactory than the optimized world of full control and precise prediction. But the realistic planning suggested may do better for the world as it actually is than the idealizations of the unfulfillable plans so frequently laid out.

The remainder of this Report applies the criteria of this new kind of planning to health care planning for a particular state. It comes up with few positive recommendations, but it does suggest a structure for planning that can reach such recommendations. Because related Rand work concerning Illinois is ongoing, the data and examples are taken from the Illinois data.

III. PHYSICIANS

Among all categories of medical personnel, the production of physicians requires the longest lead-time since they require a long period of training. Therefore, the general precepts of flexibility in training suggested above are the least applicable here. A system that requires ten years or more from the beginning of college to the end of residency, and requires highly trained professionals to train more professionals, must make some attempt to estimate in advance how many physicians will be desired at future dates, and how this desire will be filled. However, many of the standard instruments for increasing supply—increased medical school enrollment, for example—are demonstrably so ineffective for use by a state that more powerful and more flexible alternatives are needed. Several alternative ways of increasing the supply of physicians are suggested below, although they may well be insufficient. The prognosis is guarded at best.

Because state-by-state distribution of physicians has received considerably more attention in previous studies, we can be more precise here about ways to increase the *total number* of physicians in a state, such as Illinois, than we can about changing their *distribution* within the state. Nevertheless, local distribution is important and will also be discussed.

INCREASING THE NUMBERS OF MEDICAL SCHOOL GRADUATES

One way to try to increase the numbers of practicing physicians would be to increase the enrollment in medical schools and hope that a significant proportion of the additional graduates eventually practice in the state. However, for our case study of Illinois, both historical retention rates and recent experience with the costs of medical education in the state suggest this may be an expensive alternative.

A casual review of gross retention rates shows considerable variation. Table 1 indicates the percentage of graduates from Illinois medical schools who were practicing in Illinois in 1967. The average retention for all Illinois medical graduates is 34 percent, but the individual schools vary from 20.4 to 45.6 percent. Even the highest retention rate in the state is scarcely above the national average of 42.8 percent.

Table 1

MEDICAL SCHOOL GRADUATES IN PRACTICE BY SCHOOL IN RELATION TO STATE OF PRACTICE, DECEMBER 31, 1967

School	Total Number of Graduates in Practice	State of Practice					
		Same		Contiguous		Different	
		Number	Percent	Number	Percent	Number	Percent
Rush Medical College	2,692	651	24.2	315	11.7	1,726	64.1
University of Chicago	1,987	406	20.4	132	6.6	1,449	72.9
Northwestern University	5,874	1,407	24.0	599	10.2	3,868	65.8
University of Illinois	6,735	3,074	45.6	561	8.3	3,100	46.0
Chicago Medical School	2,268	814	35.9	58	2.6	1,396	61.6
Loyola University	3,436	1,469	42.8	283	8.2	1,684	49.0
All Illinois	22,992	7,821	34.0	1,948	8.4	13,223	57.5
All United States	252,633	108,009	42.8	37,654	14.9	106,970	42.3

Source: Theodore, Sutter, and Haug (1969), pp. 652-653.

Table 2

PROPORTION OF ILLINOIS MEDICAL SCHOOL GRADUATES PRACTICING IN ILLINOIS BY YEAR OF GRADUATION

School	Year of Graduation							
	Before 1950		1950-1954		1955-1959		1960-1964[a]	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Rush Medical College	650	24	1	100				
University of Chicago	144	18	65	21	62	18	82	24
Northwestern University	807	23	174	23	108	16	171	26
University of Illinois	1,712	46	347	43	357	46	397	45
Chicago Medical School	658	61	63	18	36	11	30	10
Loyola University	924	45	149	39	160	40	140	38

Source: Theodore, Sutter, and Haug (1969), pp. 488-493.

[a]State of practice for graduates 1965-1967 is not reported because most had not finished internship, residency, or military service and had not yet started full practice.

If we want to consider the impact of a change in medical enrollment, however, average past retention rates are at best a loose guide. We should attempt to estimate the retention rates among *additional* graduates of Illinois schools if enrollments are increased. This could be a major research program in itself,* but recent trends may be helpful. Table 2 gives the number of graduates practicing in Illinois in selected time periods by medical school; it shows that retention is becoming increasingly difficult. This general downward trend in retention rates for the graduates of Illinois medical schools is confirmed in another manner. Table 3 shows that an increasing percentage of the physicians practicing in Illinois received their medical education outside the state.

Table 3

MEDICAL EDUCATION OF PHYSICIANS PRACTICING
IN ILLINOIS BY YEAR OF GRADUATION

	Year of Graduation			
	Before 1950	1950-1954	1955-1959	1960-1964
Number Practicing in Illinois	6,971	1,212	1,173	1,300
Number Educated in Illinois	4,895	799	723	824
Number Educated Outside Illinois	2,076	413	450	476
Percent of all Physicians practicing in Illinois who were trained in Illinois	70	66	62	63

Source: Theodore, Sutter, and Haug (1969), pp. 577-578.

Thus. two conclusions about physician location are that: (1) given current characteristics of the students and incentives for location, the majority of graduates from Illinois medical schools practice elsewhere; and (2) an increasing percentage of those who practice medicine in Illinois received their formal education outside the state. Together, these two results throw substantial doubt on state-financed expansion of medical schools as an effective way to increase the number of physicians practicing in the state.

This primary conclusion is reinforced by the variable (but high) costs of medical school expansion. Accurate cost accounting for medical schools is very difficult because the nature of the "product" is complicated and because the sources of revenue are confounded—it is not clear which revenues pay for what training, what research, what patient care. This makes it difficult to determine the cost of

*Past studies of physician location have not concentrated on forecasting the location of additional enrollees in medical schools. See, among others, Sloan (1968).

educating a physician, and it is even more difficult to estimate the cost of educating an *additional* graduate because expansion of the educational system could take any one of a variety of forms and each implies a different marginal cost. It may be that a few extra graduates could be produced by a state's system with negligible additions to the total costs of the medical schools. At the other extreme, an entirely new and separate school could be built and staffed—complete with teaching facilities and staff research programs and equipment, administration, and affiliated hospital.*

Clearly, the potential for variation in costs is tremendous. In any case, the costs of expanded medical education—themselves bearing a complex relationship to the size of the expansion—are unlikely to be absorbed by proportionate increases in all current sources of revenue for the medical school. For instance, federal research grants are unlikely to adjust quickly to a change in enrollment. Revenues from tuition may be more responsive, and the school's chief financial underwriter (whether a state education system or private funding) will probably be asked to absorb a significant share of the increased expenses.

Although we cannot estimate cost precisely, we can be sure that the costs for adding more practicing physicians to the state's rolls through expanded medical school enrollment will be very high indeed. Take as an example a program of giving $6,000 per year per student above current levels of support to medical schools for accepting additional students. If the state retention rates for these additional students are similar to those of recent graduates, then admitting three more students to Illinois medical schools in the current year will produce one non-specialist physician ready to practice in Illinois seven or eight years later at a four-year annual cost of $18,000. † The present capital value (at 6 percent) of the $18,000-per-year subsidy to produce this one physician starting practice in Illinois in several years will then be $66,000. If his income when he starts practice is a measure of his value to the state, this income would have to be carried at the rate of more than $6,800 a year for 35 years to justify the $66,000 now. That means that these additional doctors will have to generate an additional value to the people of Illinois of at least $6,800 per year above their total fees to justify additional subsidy of their education. This particular example is chosen mainly for illustration, but it seems likely that this is a conservative estimate of the cost to the state for each additional physician practicing in Illinois if enrollments are expanded. ‡

The conclusion is straightforward: increasing enrollments in Illinois medical schools is a difficult and expensive way to increase the supply of physician services in Illinois.

*It has been suggested that a new school will require a capital investment of $347,000 to $663,000 per student. Furthermore, new schools—whether private or public—take an average of nine years to produce their first graduate. The report to the Board of Higher Education called for state construction grants of $50,000 per additional Illinois resident enrolled for medical school expansion and continuing support of $6,000 per year for each additional Illinois resident enrolled in the school. See Illinois Board of Higher Education (1968, Vol. I, pp. 19-24).

† This assumes four years of schooling, one year for internship, and two or three years for national service.

‡The state will also receive some additional physician services as additional medical students (even those not remaining in Illinois) receive their training. This point is developed more fully below.

ATTRACTING AND RETAINING ADDITIONAL PHYSICIANS

The previous discussion implies that the key to the supply of physicians lies in physicians' decisions as to where they will practice. But, as one might suspect, physician location behavior is complex and no empirical study has completely explained observed behavior. However, six studies of variables influencing physician locations are listed in Table 4. These were chosen for their relatively recent data base and for their attempts to simultaneously account for a multiplicity of factors. Since this literature is reviewed and criticized by Sloan and Yett in a forthcoming paper, we will concentrate on the policy implications. Before reviewing the six studies, however, a few comments are needed on this type of analysis.

Empirical analysis is difficult because a clear, comprehensive theory of physician location behavior to test against the observed data is lacking. In addition, many of the variables that might be used in analysis are proxies for the real variables that might be studied, for instance, the number of hospitals may be used as an independent variable when the investigator really wants to analyze the effect on physician location of the ease of gaining hospital privilege.

Another difficulty with empirical studies involves the complexity of the models. Studies have frequently tried to explain the supply of physicians to a given location without taking account of the fact that the raw data are produced not by supply considerations alone, but by the interaction between supply and demand effects. For instance, on the supply side, physicians may tend to locate in higher income areas and charge higher fees. On the demand side, individuals may purchase fewer physician services (other things being equal) when the fees are higher—but they may also purchase more physician services when they have higher income (other things being equal). Simple models will not be able to sort out these effects. Complex multiple-equation models may do a better job, but they may also encounter data constraints more rapidly than single-equation models, the absence of a clear underlying theory may lead to specification errors in the equations actually estimated. And, finally, just because a study may reveal a correspondence among variables, empirical studies alone do not establish causal relations.

The nature of the empirical findings on physician location are summarized in Table 4. Almost thirty different variables have been used to explain the data in these studies. The table indicates the direction (positive or negative) of the influence of each explanatory variable on the dependent variable measuring location. The parentheses indicate that the influence is not significant at the 0.05 level (two-tail test).* We have grouped the explanatory variables into five categories: remuneration, population, size, desirability of the areas, educational variables, and professional opportunities. These categories are somewhat arbitrary and do not necessarily correspond to the interpretation assigned to a given variable when investigated by a particular study. Again, we refer the interested reader to Sloan and Yett for a detailed discussion of the interpretation of these variables.

*Rimlinger and Steele (1963) run only cross-tabs on three variables and find them mutually positively correlated; Steele and Rimlinger (1965) do not report significance levels for their coefficients.

Table 4

VARIABLES INFLUENCING PHYSICIAN LOCATION IN SIX EMPIRICAL STUDIES[a]

Study Category	Rimlinger and Steele (1963)	Steele and Rimlinger[b] (1965)	Ball and Wilson (1968)	Benham, Maurizi and Reder (1968)	Sloan (1968)	Lee and Wallace (1969)
Model (number of equations)	1[c]	1	1	2	8	6
Unit of Observation	County groups within states	A B C D E[d]	County groups within states	State	State	State
DEPENDENT VARIABLE	MD visits	MDs per 100,000	F G H I J[d]	Self-employed MDs	All employed MDs	MDs per 100,000
INDEPENDENT VARIABLES						
REMUNERATION						
Per capita income	+	+ + - - -	+ + + + -			-
Change in income		+ + + + +				
Physician income				(+)	(+)	+
Physician fees	+					
Cyclical sensitivity of physician income					+	
POPULATION SIZE						
Change in size			- (+) - - (+)	+		
Bed disability days		+ - + + +	(+) - (-) (+) -			
DESIRABILITY OF AREA						
Urbanization/density			+ - + + -	+		+
EDUCATIONAL VARIABLES						
Medical schools in state			(-) + (-) (-) +	(+)		
Medical schools in area			+ (-) + + -			
Number of medical school students or graduates					+	+
Educational expenditure					+	
Medical students from state					(-)	
PROFESSIONAL OPPORTUNITIES						
Hospital privilege - capital stock (Proxy in Sloan, 1968)					+	
Number of supporting personnel						+
Failure rate on licensure exam				+	(+)	

[a]Plus and minus signs indicate the positive or negative direction of the influence of each explanatory variable on the dependent variable measuring location. Parentheses indicate a t-ratio less than 2.

[b]Significance levels are not reported.

[c]Cross tabs--positive among three variables.

[d]A -- Isolated rural counties, by state
B -- Isolated semi-rural counties, by state
C -- Adjacent counties, by state
D -- Lesser metropolitan counties, by state
E -- Greater metropolitan counties, by state
F -- MDs and Osteopaths per 100,000
G -- GPs per 100,000
H -- MDs under 60
I -- MDs not GPs per 100,000
J -- GPs as percentage of MDs.

Remuneration

Almost every investigator has suggested that, all other things being the same, physicians will locate where they will earn a greater income. Most studies do find a positive effect of remuneration variables, but, unfortunately, the estimated relationship is not always significant—probably because "all other things" are not properly accounted for.

The most conceptually detailed model of physician location has been developed by Sloan. Using several variants of a complex model, his investigation suggests an income elasticity of supply of physicians for a state of around 0.29; that is, a 1 percent increase in earnings will result in a 0.29 percent increase in the number of physicians—all other things remaining the same (Sloan, 1968, Chap. 8). Another particularly interesting (and statistically significant) income effect found by Sloan (1968, p. 358) is that physicians tend to locate where there is less cyclical variation in income levels.

Population

Population size or change in size may be proxy variables indicating regions where a physician could earn a larger income—either because there is a current or anticipated excess demand. It appears, in general, that either population size or net change have a positive effect, all other factors given.

Desirability of the Area

A number of studies have tried to take account of features of an area that may attract physicians—including climate, urbanization, population density, crime rates, and so forth. There are many problems with the selection of appropriate measures for these effects, and the analysis is confounded because areas with distinctive living conditions frequently have higher levels of income, a medical school, or unusual levels of other variables. Moreover, due to data restrictions, the studies have measured state-by-state differences, which may be too aggregated to detect the real impact. The Ball and Wilson (1968) study suggests that specialists and younger physicians are found in less densely populated areas.

In net, differences in the desirability of areas do not seem to be adequately captured in any of these models. This is not too distressing from a policy point of view because the climate and other such factors are not subject to the policymaker's control.

Educational Variables

Sloan's (1968) formulation simultaneously allows for number of medical school students, number of medical school students from the state, and expenditure on education. The results show a positive and significant impact on location of

numbers of medical students and expenditure on education, but not of the number of medical students from the state. The study by Lee and Wallace (1969) supports the findings of a positive impact of a medical education program on the number of physicians in an area.

Professional Opportunities

The final category of variables used to explain physician location is conceptually attractive but difficult to measure. The results are not unambiguous, but they suggest a positive effect on physician supply if hospital privilege is easier to secure and a negative effect on General Practitioner entrants if there are more specialists in a state.

One of the earlier unexpected findings of Sloan (1968), and Benham, Maurizi, and Reder (1968) was the failure rate on the licensing examination was positively associated with the numbers of physicians in an area. Both studies concluded that other factors must be attracting both foreign medical graduates (who contribute heavily to the failure rates) and U.S. medical graduates to the same areas (especially major cities on either coast).

Summary of Empirical Findings

All studies reported in Table 4 try to explain the numbers of physicians in an area or moving to an area. However, if our real interest is the quantity of physician *services* to patients (as compared to research, for example), then such studies are only a partial guide.

Two policy variables seem to contribute consistently to the location behavior of physicians: remuneration and medical school activity. Sloan (1968) presents the most detailed analysis of these variables. As mentioned above, his analysis indicates that an increase in physician income of 1 percent will be associated with an increase of 0.29 percent in the number of physicians in a state. If it were possible to subsidize the income of only an additional physician, it would cost the state on the average of about $300 to attract one more M.D.* In contrast, Sloan calculates that on the average, it would cost a state over $300,000 to add one more physician to the state's supply by constructing medical schools. Since Illinois has a below-average retention rate for its graduates, the implication is that this is a conservative estimate of the expected costs per additional physician located in the state because he went to medical school there.

*That is, the present discounted values of a lifetime income subsidy. It should be noted, however, that subsidization works best if only one state does it. If other states were to try to center the attraction with their own subsidies, it would be all too easy to get into a situation analogous to a trade war, from which no one benefits.

ADDITIONAL MEASURES TO ATTRACT AND RETAIN PHYSICIANS

In addition to the *fee subsidy* just discussed (which could continue or be limited in time), there are at least two other remuneration activities that may be open to a policymaker.

Forfeitable Loans

Loans could be made either to students or to physicians starting practice. Part or all of the loan could be forgiven if the physician practiced in the state for a certain period. There are, of course, several variants possible—including state residence to qualify, and so forth.

Relocation Subsidies

Physicians could be offered a subsidy to establish a practice in the state. Again, it is obvious that a variety of conditions could be attached.

ANOTHER WAY TO INCREASE PHYSICIAN SERVICES AVAILABLE: CHANGING THE LENGTH OF CLINICAL TRAINING

Not all location decisions are completely voluntary on the part of physicians. Once the student or physician has made his commitment to a program for medical education, internship, or residency, he is likely to complete it at the same place he started. Thus, a final alternative that may be considered by policymakers is to change the *length* of such programs. For instance, suppose a 4-year curriculum were expanded to 5 years, and the extra year was spent in a clinical setting. This would mean more than 500 additional persons in Illinois using their medical training in such clinical settings. Even though these students probably would not provide as many medical services as an equivalent number of physicians, such a program could have a significant impact on the availability of services in selected locations. Similar changes in program length or location might be considered for internship or residency programs.

This is not a facile solution. Physicians would have to be induced to lengthen an already long training program, and would have to be convinced of the professional benefits to *them* of such an increased weight of early supervised practice. Properly approached, however, the potential for short-run increase in physician services might make such an effort worthwhile. It might be particularly useful to increase services in those areas within the state where shortages are especially acute.

WITHIN-STATE DISTRIBUTION OF PHYSICIAN SERVICES

Although most of the measures discussed above seem likely to apply to physician location within a single state as well as to physician location decisions among states, far less systematic empirical attention has been paid to the within-state distribution problem. We know that there are many more physicians per capita in cities than in rural areas; this pattern holds for Illinois as elsewhere. But we have much less specific information on decision-affecting factors than in the among-state cases. Steele and Rimlinger (1965) make separate estimates for each of five different geographic regions. They employ only three explanatory variables, but it appears that income is relatively more important to rural location than to non-rural. Beyond this single tidbit, little information exists.

Lacking anything better, it seems likely that the policy suggestions discussed above will influence within-state location decisions as much as those among states. Fee subsidies, relocation bonuses, hospital privileges, proximity to a teaching facility, and clinical training may each have an impact. The location and length of clinical training, in particular, may have some effect on local availability of physician services.

Two additional measures to influence the local delivery of services can be considered.

Changing the Location of Clinical Training

The report of the Health Education Commission to the Illinois Board of Higher Education recognizes the possibility of changing the place of clinical training when it advocates placing training programs in existing facilities. We will not attempt here to measure the volume of services currently being delivered by persons in training—nor that which might be available if clinical programs were lengthened as discussed above—but such estimates will be crucial in evaluating alternatives. Medical education is now quite variable, with some students gaining clinical experience in their first year of schooling, and others completing their basic sciences first. Similarly, the amount of patient contact in internship and residency programs is anything but uniform. In some locations, placing a training program in the area may be the easiest way to deliver physician services. Obviously, many variations could be made: for example, personnel in training and their instructors could live elsewhere, and rotate through different programs in different locales.

Transportation Alternatives

In particular areas where travel is difficult or unpleasant, transportation subsidies might be considered. Alternatively, transportation facilities or services may be offered. For example, standby air travel capacity for certain types of prob-

lems with a low incidence widely dispersed geographically over a given population might be provided through a special air fleet.

CONCLUSION

The major implication of this section is that it is obvious that it is necessary to take account of complexity. Many measures, including some not discussed here, may have some effect on physician location and availability of services. But each of them will work partially at best, and through complex mechanisms. And the measure most frequently thought of—increase of medical school capacity—may not work at all for states like Illinois or other localities.

IV. DENTISTS

Much less empirical work has been done on the dental profession than on physicians. The work that has been done, however, tends to conform generally with the major findings discussed in Section III for physicians. In particular, the conclusion that physician location is sensitive to remuneration is reinforced for dentists by Maurizi's findings (1969) that applications to schools of dentistry vary closely with returns to practicing dentists.

The major positive policy conclusion for physicians—that a state which wishes to attract and retain them might well work through their financial returns —would thus also seem to apply to dentists. Some differences between physicians and dentists do exist, however, and these indicate the possibility of using policy devices for dentists that were less applicable for physicians.

Probably the most significant difference is in mobility. Dentists are more mobile than physicians within the state, but less mobile among states. Two factors seem to account for this distinction. First, dentistry is conducive to solo practice, with relatively small capital investment and insignificant need to locate near other medical facilities. Second, state licensing procedures apparently act as a substantially more significant barrier to interstate migration for dentists than for physicians (Holen, 1965).

Thus, in policy terms, a state wishing to attract and retain dentists might consider:

1. Relaxing licensing requirements for dentists trained out of state; and

2. Expanding the capacity of schools of dentistry within the state.

So long as interstate mobility remains low (assuming, perhaps, that *other* states keep their licensing barriers high), such capacity expansion is likely to have substantially more payoff than in the case of medical schools. This conclusion should be qualified in one way, however: Unlike medical schools, dental schools have had enrollments significantly under capacity as recently as 1963 (see Maurizi, 1969). Although the number of qualified applications has exceeded the number of admissions since then, the close relationship of applications to returns to dental practice implies

at least a possibility of dental school "overcapacity" if returns drop relatively. It would thus seem particularly important to couple any state increase in dental school capacity with income maintaining measures that would ensure a continued substantial stream of applications.

V. NURSES

Several aspects of nursing distinguish it from other health professions. First, it is generally womanpower, not manpower, and this has important implications for migration and labor force participation. Second, the nursing "shortage" is largely a hospital phenomenon and reflects the fact that hospitals would like to have more nurses *at the wages they are now paying* (cf. Yett, 1970). Illinois does not seem to differ sharply from the rest of the country in its nursing problem. In 1966, the ratio of active registered nurses to total population was slightly higher than in the United States as a whole (330 versus 313 per 100,000; American Nursing Association, 1969, p. 12). Further, the proportion of RNs employed as nurses and non-nurses closely parallels the rest of the country.

Working RNs	Employed as Nurses	Employed as Non-nurses	Not Reported
Illinois	69.6%	32.9%	6.2%
United States	65.3	31.4	3.3

Source: American Nursing Association, 1969, p. 13.

The point is that Illinois does not seem to be sufficiently different from the rest of the country to necessitate radically different means of increasing nursing services.

More than other health professions, the key to the nursing "shortage" seems to be participation rates—the levels of work activities provided by the existing large numbers of women trained and licensed as nurses. There are about 1,100,000 trained nurses in the United States. About half of the women trained as nurses work as nurses, about one-fourth maintain their registration but do not work as nurses, and one-fourth have let their registration lapse. Current Rand research for the City of New York suggests that nursing participation may be a problem heavily dependent upon details—perhaps differing from hospital to hospital or even service to service. Unmarried nurses may be especially interested in location, amenities, social con-

tacts, housing, and hours. Married nurses may be especially influenced by their husband's location and work schedule, the demands of their children, availability of child care, and convenience of hours.

The literature on career decisions seems to reinforce the suggestion that the best way to increase nursing services is to work on participation rates. Nurses seem to make an early career decision. Table 5 summarizes the age of career decision for students in nursing diploma and degree programs, non-nursing students, and medical students. Notice that only 10 percent of the enrollees in nursing programs decided to enter nursing above age 17 (similar to the pattern for MDs), whereas 41 percent of the non-nursing students decided after age 17. The presence of a large pool of trained persons not working as nurses combined with the early pattern of career choice suggests that efforts to increase the quantity of nursing services should concentrate on the labor force participation rates of nurses rather than production of additional nurses.

Table 5

AGE OF CAREER DECISION FOR NURSING STUDENTS, NON-NURSING STUDENTS, AND STUDENT PHYSICIANS, PERCENT DISTRIBUTION BY TYPE OF PROGRAM, ALL YEARS COMBINED

Age of Career Decision	Diploma Students (N=1666)	Degree Students (N=572)	Non-nursing Students (N=214)	Student Physicians (N=741)
Before 10	26%	25%	5%	24%
10-13	17	15	7	27
14-15	18	21	14	18
16-17	27	26	31	17
After 17	10	9	41	14
No response	2	4	2	0
Total Percent	100	100	100	100
Median age	14	14	17	13

Source: Fox, Diamond, and Jacobowsky (1967), p. 159, and Rogoff (1957), p. 111.

Two comments about nursing education are appropriate. First, the job content of the nursing profession has changed significantly in the last few decades. Nurses are increasingly becoming administrators with significant amounts of paperwork and managerial problems. Indeed, this concentration on nonpatient-contact duties is often cited as a reason for women dropping out of the nursing force. Schools of nursing seem to have been slow to adjust their curricula to this fact and to prepare

their students for this modified role. See Altman (1970) for details, including a historical discussion of the changing job content of nursing. Second, if we are to encourage more nurses to return to nursing, then increased attention may be focused on refresher courses and other means of rekindling interest in nursing (and costs of refresher courses might be made tax deductible, which they are not now). It may also be important to include some education in managerial techniques in these refresher courses.

VI. ALLIED HEALTH PROFESSIONALS

The current crisis in health care has focussed increased attention on the possibility of a much greater share of care being provided by specialized allied health personnel: physician assistants, nurse-midwives, nurse's aides, pediatrics assistants, specially-trained emergency personnel, and so forth. These persons might perform some of the functions now practiced by physicians, but they would not have the extensive broad education of a medical doctor. Although current interest in Allied Health Professionals is crisis-based in part, this recent interest reflects a long-term trend in medicine. In 1900, there were equal numbers of non-physician health professionals and medical doctors; in 1970, the ratio is about 13 to 1; and in 1975, some projections suggest a ratio of 20 or 25 to 1.

The particular interest in physician assistant-type personnel has at least three motivating forces. First, there is a widely felt "shortage" of physician services. Second, physicians and others feel that a number of the duties doctors now perform can be satisfactorily carried out by persons with less extensive medical training. Third, a pool of between 20,000 and 30,000 military medical corpsmen return to civilian life each year with some intensive medical training and experience, and many of these men may constitute a motivated group of competent manpower.

This issue of allied health manpower is important to the planning of any medical education program for two reasons. First, there is the intrinsic need to plan and develop appropriate programs if such manpower is to be utilized. Second, we need a clearer understanding of the role and availability of allied health personnel if we are to adequately assess the demand for physicians and other personnel.

The overwhelming feature of planning for the production of allied health personnel is uncertainty. Some of the allied health personnel are in relatively well-developed occupations like laboratory technicians, but much of the new growth is likely to come in the rapidly developing category of physician assistants, and it is not clear what will be the *role* of such physician assistants. They could function (1) as the point of primary contact for persons seeking medical care, performing preliminary workup and triage; (2) as specialized assistants, performing detailed duties, but only on a narrow range of problems; or (3) as general assistants, under close and direct supervision of physicians. Adding to the uncertainty about their role, questions of *legality* are not fully resolved for physician assistants. Is the

physician with whom they might work to be ultimately responsible, or are physician assistants individually responsible? Are they to be allowed to perform specific actions, or are they to be allowed to perform certain types of care? These areas of uncertainties interact with uncertainty about the *technology* and *organization* for the delivery of medical services. And, finally, there are questions about the acceptance of physician assistants—not only by medical doctors but also by nurses and patients.*

All of the uncertainties specific to the utilization of allied health professionals are multiplied by the general uncertainties in predicting future "need" or "demand" for health care, discussed above. The significance of this uncertainty for planning is two-fold. Facilities and programs should be developed with sufficient *flexibility* so that they can be adapted as the role of the physician assistant becomes clearer; the planners will have to gather information about some of the areas of uncertainty in order to develop appropriate programs.

A number of points can be made now, however, in order to help direct the flexibility and order the uncertainty:

1. Although precise demands are uncertain, we can be quite certain that the trend in the need for allied health personnel is upward. We can plan for substantial expansion of training facilities and programs without worrying too much at this time about the ultimate level of needs. Lead times both for training medical technologists and for setting up training programs are much lower than for physicians, so planning can be flexible and relatively short term.

2. At this point in time, Illinois is doing rather well in the training of allied health personnel. Among the five fields with substantial numbers of programs already going within the United States, Illinois ranks third in programs to train Certified Laboratory Assistants, seventh for Cytotechnologists, first for Inhalation Therapy Technologists, second for Medical Technologists, and fourth for Radiologic Technologists. (U.S. Congress, Senate, 1970, p. 83.) The important questions for the future, however, are less among these established fields than in the newer ones, of which physician assistants are typical.

3. Interstate migration among trained medical technologists is substantially lower than among professionals, particularly physicians, so expanded training will pay off for the state. Increasing federal funds are also becoming available for the purpose.

4. According to the AMA, some of the major trends in training allied health personnel are:

- The place of such programs on college campuses rather than in hospitals as has traditionally been the case;
- The very rapid growth of such programs in the proliferating community colleges throughout the nation;
- The emergence of new colleges of allied health professions;

*For a more detailed consideration of some of these issues, see Carlson and Athelstan (1970) and American Medical News (1970).

- The growth of core curricula to train together different sorts of professionals and technicians who will later work together as teams. (U.S. Congress, Senate, 1970, p. 78.)

5. As noted above, as many as 20,000 to 30,000 medical technicians of various sorts return to civilian life from the armed forces each year. But, at this point the health care system is not well geared up to train or utilize them. (U.S. Congress, Senate, 1970, p. 182.) The states that first break through various barriers of acceptance, licensing, and financing training may quickly tap into a major bonanza.

6. Training is not the whole story, however. As in the case of all the other health occupations—all occupations, for that matter—the salary offered makes a big difference in the number of people applying for the job. In the case of health, low salary is a particularly important additional barrier to the employment of the increasing numbers of military veterans. According to Dr. Kenneth Endicott, Director of the Bureau of Health Professions Education and Manpower Training:

> I think probably the most important single factor [in the shortage of allied health personnel] has been that the pay scales in all of the fields of allied health have been so low that men don't go into these areas. For the most part, young women, high school graduates, go into these areas with the expectation of having a job until they get married and something perhaps to supplement their husband's income with later on. (U.S. Congress, House, 1970, p. 22.)

As a result of all this, what is needed is a responsive and flexible system, whereby not only state authorities but also local hospitals, clinics, and physicians can signal local training facilities such as community and senior colleges and other training programs, and local training counselors as to needs a few years ahead. Cooperative Area Manpower Planning Systems (CAMPS) being set up in many areas under U.S. Department of Labor guidance should also help. But training—even flexible training—is clearly not enough. Use of ordinary pay incentives would in itself go a long way toward attracting the already partially trained veterans of military medical service to remain in this field of endeavor. The interstate "trade war" problem alluded to above in regard to physicians is much less acute for allied professionals. The more serious problem in the allied services is attracting personnel away from other occupations, not other states.

But what is badly needed is more serious attention to the problems, in local and state contexts. One means of approaching the flexible planning problem is to create some scenarios of likely developments in the health arena over the next five to ten years and to work out the planning implications of these scenarios. Such an approach might consider a variety of sources of trainees: corpsmen, nurses, persons who decide not to complete medical school, and so forth. Then a variety of training programs can be considered—ranging from programs with extensive formal instruction to those with a heavy emphasis on clinical experience and an apprenticeship

period. The variation in medical care technology can be combined with different legal constraints and variation in the acceptance of each type of personnel. The simplest act of explicating such scenarios will reveal many issues that will guide program planning and development. For instance, a program may train students for practice that is not permitted in the state in which the program is operated. Will the graduates migrate or will the pressure develop to change the state law? What effect will this have on long-run recruitment, training, and retention? Ultimately, this approach may be used for detailed planning and development if the decision-maker places a probability distribution over the likelihood of each scenario occurring and then chooses the program which gives him the best expected outcome. Such detail may turn out not to be necessary or cost-effective, but it can serve as the final step in the analysis.

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